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EFFECT OF DIFFERENT LEVELS OF IBA AND NAA ON ROOTING OF HARDWOOD AND SEMI HARDWOOD CUTTING IN FIG

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ABSTRACT

The investigation was carried out to study the effect of different levels of IBA and NAA on the rooting of hardwood and semi hardwood cuttings of Fig. The highest percentage of rooting, maximum number of roots, longest root length per cutting and maximum survival percentage of rooted cuttings was obtained with IBA 4000 ppm followed by IBA 2000 ppm in hardwood cuttings. Among different levels of IBA and NAA, IBA 4000 ppm recorded maximum root length, survival percentage and other shoot characters as compared to rest of the treatments. Thus, Fig can be propagated by hardwood cuttings treated with IBA 4000 ppm.

KEYWORDS: Ficus Carica, IBA, NAA, Hardwood and Semi Hardwood Cutting

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Original Article

INTRODUCTION

Fig is an important deciduous fruit crop in tropical and sub tropical countries. It belongs to family Moraceae. The Figs are consumed fresh, dried, preserved, candied and canned. Fresh Figs are delicious and used as dessert or for jam. Fruits are valued for their laxative effect and for presence of many antioxidants. Among all, the vegetative propagation techniques, Fig are commercially propagated by hardwood stem cuttings in India, but the problem lies in very low or undesirable percentage of success. As the soil and climatic conditions are more suitable for cultivation of Fig, there is an ever-increasing demand for planting material in India. Under these circumstances; the present study was carried out to investigate the effect of different levels of IBA and NAA on rooting of hard wood and semi hardwood cuttings in Fig.

MATERIAL AND METHODS

The present investigation was conducted under net house in fruit nursery of Horticultural Research Farm, AAU, Anand, during 2015. Hardwood cuttings were taken from one year old shoots which were cut to have 4-5 nodes each. The length of cuttings used for planting was 20-22 cm. Semi hardwood cuttings were taken from the current season's growth. The leaves were removed from the cuttings and were trimmed to the required length by removing the terminal portions just above a bud. The basal end of the cuttings was given a slanting cut to expose maximum absorbing surface for effective rooting. The treatments were IBA (2000, 4000, 6000 ppm), NAA (2000, 4000, 6000 ppm), distilled water without growth regulator (control) and absolute control. The prepared cuttings were treated with plant growth regulators by quick dip method for 25 seconds and were allowed to dry for 15 minutes and then planted in sand. The experiment was laid out in completely randomized block (factorial) design with three repetitions. After 30 and 60 days of planting, the cuttings were uprooted carefully from the sand bed without damaging the roots and washed in water. The percentage of rooting, average number of roots and shoots per cutting and length of the longest

root and shoot per cutting were recorded. For the survival percentage of rooted cuttings, 20 rooted cuttings after 60 days of plants were transplanted in poly bags containing garden soil and well rottened FYM. The survival percentage of transplants was recorded 3 weeks after transplanting.

RESULTS AND DISCUSSIONS

Percentage of Rooting

The percentage of rooting was significantly influenced by the application different levels of IBA and NAA in hardwood cuttings of Fig (Table 1). Harwood cutting recorded more percentage of rooting (65.02%). Among the IBA and NAA treatments, the highest percentage of rooting was recorded with IBA 4000 ppm in hardwood (73.24%), while absolute control recorded the lowest percentage (27.00%) of rooting over all other treatments. This might be due to the fact that auxins are known to induce stimulus for regeneration of roots by promotion of hydrolysis, mobilization and utilization of nutritional reserves in the region of root formation. Similar results were reported by Siddiqui and Hussain (2007) in *Ficus hawaii*. Further, the superiority of IBA in producing highest percentage of rooting compared with NAA might be due to its greater chemical stability and low mobility in plants.

Number of Primary Roots per Rooted Cutting

The data presented in Table 1 clearly indicate that maximum number of roots i.e. 4.36 and 8.80 per cutting was observed in hardwood cutting. It might be due to presence of higher stored carbohydrate in hardwood cutting than semi hardwood. Among the different IBA and NAA levels, IBA 4000 ppm recorded the maximum number of roots (5.90 and 10.87) per cutting at 30 and 60 DAP, respectively. This might be due to the positive response of auxin induces an accelerated rate for root initiation and consequent production of more number of roots. Application of auxin affected the regeneration of roots on cuttings. The effectiveness, however, varies with the nature and concentration of auxin (Hartman *et al.*, 2011). There was a reverse tendency in average number of roots with increasing concentrations. This may be because of the reason that auxin helps in rooting behavior only up to certain limit. These results are in conformity with Karakurt *et al.* (2009) in MM106 apple rootstock.

Number of Shoots

Data (Table 1) clearly indicated that among maximum number of shoots i.e. 1.48 and 4.17 per cutting was observed in hardwood cutting as compared to semi hardwood cutting at 30 and 60 DAP, respectively. It might be due to more utilization of the stored materials lead to early initiation of shoots in hardwood cuttings. Among the different levels of IBA and NAA, IBA 4000 ppm also recorded highest number of shoots (2.10 and 6.23) as compared to rest of the treatments at 30 and 60 DAP, respectively. It showed significant influence on number of shoots per cutting. Variation in growth parameters due to different levels of IBA and NAA can be attributed to variation in mobilization of auxin within cuttings, their effect on hydrolysis of reserve food material into reducing and non reducing sugars, phenolic compounds and metabolites. The results are in conformity with Sharma *et al.* (2009) and Raut *et al.* (2015) in pomegranate.

Table 1: Effect of Different Levels of IBA and NAA on Rooting and Number of Roots on Hardwood and Semi Hardwood Cuttings of Fig

Treatments	Percentage of Rooting		Number of Roots		Number of Shoots	
	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP
Hardwood	49.60	65.02	4.36	8.80	1.48	4.17
Semi hardwood	40.52	50.67	2.84	6.57	1.20	3.12

Table 1: Contd.,						
S.E m ±	1.22	0.66	0.07	0.09	0.04	0.06
C.D. at 5%	0.42	0.22	0.20	0.26	0.12	0.17
IBA 2000 ppm	50.32	66.51	3.34	9.20	1.64	4.60
IBA 4000 ppm	58.96	73.24	5.90	10.87	2.10	6.23
IBA 6000 ppm	53.02	61.67	3.57	8.34	1.44	3.63
NAA 2000 ppm	49.96	64.15	4.00	8.43	1.37	3.27
NAA 4000 ppm	52.55	70.64	5.07	9.14	1.84	5.16
NAA 6000 ppm	46.04	58.59	3.00	7.23	1.16	3.50
Control	27.10	37.40	1.84	4.30	0.70	1.56
Absolute control	22.57	30.17	1.44	4.00	0.50	1.23
S.E m ±	0.84	0.45	0.13	0.18	0.08	0.12
C.D. at 5%	2.44	1.32	0.40	0.52	0.25	0.35
Interaction	Sig	Sig	Sig	Sig	Ns	Sig

Length of Longest Root per Cutting

Data presented in Table 2 showed that hardwood cutting recorded maximum root length of 4.42 and 7.16 cm at 30 and 60 DAP, respectively. It might be due to the presence of more starch, which in turn brings out a favorable condition for root initiation which ultimately increases the root length. Contrary to this, highest root length i.e. 5.55 and 10.63 cm was measured under IBA 4000 ppm at 30 and 60 DAP, respectively (Table 1). It might be due to IBA promotes root length by influencing the synthesis of enzymes, which are concerned with the cell enlargement. In case of the interaction, longest root length (6.57 and 12.04 cm) was recorded by treating hardwood cutting with IBA 4000 ppm (Table 2)

Length of Longest Shoot

Hardwood cutting recorded maximum shoot length i.e. 3.53 and 6.17 cm as compared to semi hardwood cutting at 30 and 60 DAP, respectively. The results may be attributed to the well developed root system in such cuttings which might have tended to promote shoot growth by ensuring adequate mobilization of water and nutrients from the soil or substrate to the growing apices.

Among the different levels of IBA and NAA, maximum shoot length i.e. 5.01 and 8.36 cm was observed in IBA 4000 ppm at (Table 2). It might be due to auxin increase linear growth of shoot due to cell elongation and resulting in maximum length. The results are in conformity with Kumar (2014) in pomegranate and Rafael (2006) in Fig.

Table 2: Effect of Different Levels of Iba and Naa on Length of Longest Root and Shoot on Hardwood and Semi Hardwood Cuttings of Fig

Treatments	Root Length		Shoot Length	
	30 DAP	60 DAP	30 DAP	60 DAP
Hardwood	4.42	7.16	3.53	6.17
Semi hardwood	2.74	5.66	3.13	4.98
S.E m ±	0.04	0.05	0.02	0.03
C.D. at 5%	0.13	0.14	0.06	0.10
IBA 2000 ppm	4.37	8.11	4.00	6.89
IBA 4000 ppm	5.55	10.63	5.01	8.36
IBA 6000 ppm	3.98	6.47	3.73	6.25
NAA 2000 ppm	4.09	7.30	3.65	6.34
NAA 4000 ppm	4.85	8.63	4.03	7.11
NAA 6000 ppm	3.25	5.84	3.27	5.54
Control	1.47	2.53	1.80	2.59
Absolute control	1.10	1.81	1.16	1.55
S.Em ±	0.09	0.09	0.05	0.07

Table 2: Contd.,				
C.D. at 5%	0.27	0.28	0.14	0.21
Interaction	Sig	Sig	Sig	Sig

Dry Weight of Root

Hardwood cutting recorded maximum dry weight of root i.e. 0.38 and 0.54 g as compared to semi hardwood cutting at 30 and 60 DAP, respectively. Among the different levels of IBA and NAA, maximum dry weight of root i.e. 0.56 and 0.73 g was observed in IBA 4000 ppm at 30 and 60 DAP (Table 3). Which might be due to hardwood cutting contain more stored carbohydrate coupled with combination of IBA increased the number of roots resulting in higher dry weight. These findings are in conformity with Deb *et al.* (2008) in lemon.

Dry Weight of Shoot

Hardwood cutting recorded maximum dry weight of shoot i.e. 1.11 and 2.23 g as compared to semi hardwood cutting at 30 and 60 DAP, respectively. It might be due to hardwood cutting increased the number of shoots which in turn increase dry weight of shoot.

Among the different levels of IBA and NAA, maximum dry weight of shoot i.e. 1.42 and 2.42 g was observed in IBA 4000 ppm at 30 and 60 DAP (Table 3). It might be due to fact that IBA enhanced development of shoot initials and their further development. These results are in conformity with Chawla *et al.* (2012) in litchi.

Survival Percentage

Hardwood cutting recorded significantly higher survival percentage (53.4) at 3 weeks after planting in polyethylene bag (Table 3). It might be due to fact that hardwood cuttings contain more starch, which in turn increased rooting and thus more number of roots per cutting increase the survival percentage of rooted cuttings. Among the auxin concentrations, IBA 4000 ppm recorded maximum survival percentage (67.2). This might be due to more number of roots and root length at this treatment for better absorption of nutrients and moisture from the media and ultimately resulted in higher survival percentage. The present investigation is in conformity with findings of Reddy *et al.* (2008 a) in Fig.

Table 3: Effect of Different Levels of IBA and NAA on Dry Weight of Root, Shoot and Survival Percentage on Hardwood and Semi Hardwood Cuttings of Fig

Treatments	Dry Weight Of Root		Dry Weight Of Shoot		Survival Percentage
	30 DAP	60 DAP	30 DAP	60 DAP	
Hardwood	0.38	0.54	1.11	2.23	53.4
Semi hardwood	0.32	0.41	0.72	1.48	38.8
S.E m ±	0.01	0.01	0.02	0.02	0.30
C.D. at 5%	0.02	0.02	0.07	0.06	0.87
IBA 2000 ppm	0.45	0.53	1.09	2.15	58.5
IBA 4000 ppm	0.56	0.73	1.42	2.42	67.2
IBA 6000 ppm	0.43	0.51	0.96	2.12	59.2
NAA 2000 ppm	0.34	0.53	1.00	2.08	47.1
NAA 4000 ppm	0.42	0.60	1.34	2.13	56.7
NAA 6000 ppm	0.29	0.46	0.77	1.84	44.1
Control	0.20	0.30	0.45	1.29	21.3
Absolute control	0.12	0.16	0.32	0.85	15.1
S.E m ±	0.01	0.01	0.04	0.04	0.61
C.D. at 5%	0.03	0.03	0.14	0.12	1.75
Interaction	Sig	Sig	Sig	Sig	Sig

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